

WHAT IS CLAIMED IS:

1. A grommet for mounting a vehicle wire harness which includes a water trapping zone, said grommet comprising:

a longitudinal axis;

a funnel shaped portion extending along said longitudinal axis and a tubular portion joined thereto by a circular joint section;

said funnel shaped portion having a generally conical wall with external and internal generally conical faces and a flared end, the external generally conical face comprising a plurality of funnel ribs and an external circular groove with a groove base;

wherein said external circular groove is engageable with a through-hole formed in a body panel of a vehicle; and

wherein said funnel shaped portion comprises a device to improve flexibility of and/or space availability for the wire harness when mounted, including one of:

an extended tubular portion configured to hold the water trapping zone of the wire harness;

a structural configuration allowing the length of said grommet along said longitudinal axis of said funnel shaped portion to be reduced, such that the wire harness can be wired substantially alongside the body panel; and

a circular space between said plurality of funnel ribs near said circular joint section and said tubular portion.

2. The grommet according to claim 1, wherein said extended tubular portion extends from said circular joint section toward the inside of said funnel shaped portion.

3. The grommet according to claim 2, wherein said extended tubular portion comprises a cylindrical wall and an end section distal from said circular joint section, and wherein the thickness of said cylindrical wall of said extended tubular portion increases from said end section to said circular joint section.

4. The grommet according to claim 2, wherein said tubular portion and said extended tubular portion have an internal diameter smaller than the external diameter of the wire harness to be mounted.

5. The grommet according to claim 2, wherein said extended tubular portion has an external cylindrical face which comprises anti-tear-off ribs extending along the longitudinal direction thereof and joined to said conical wall of said funnel-shaped portion.

6. The grommet according to claim 1, wherein said structural configuration has a length L along said longitudinal axis from said groove base of said funnel shaped portion to said circular joint section thereof, and a diameter D in a plane normal to said longitudinal axis and including said groove base, and wherein the ratio of L : D is in the range of approximately 1:5 to 1:3.

7. The grommet according to claim 6, wherein said ratio L:D is approximately 1:4.

8. The grommet according to claim 1, wherein said plurality of funnel ribs have first end sections adjacent said circular joint section and second end sections, and radiate in multiple directions from said first end sections on said external conical face

of said funnel-shaped portion, and wherein said first end sections form a circular space around said tubular portion, such that said tubular portion can be flexed independently from said plurality of funnel ribs.

9. The grommet according to claim 8, wherein said circular joint section comprises a circular recess formed on a portion of said internal conical face of said funnel shaped portion which is opposed to said circular space.

10. The grommet according to claim 8, wherein said first end sections have a radial projection greater than a radial projection of said second end sections, and said first end sections, when viewed in a longitudinal sectional plane, extend substantially parallel to said longitudinal axis along said tubular portion.

11. The grommet according to claim 1, wherein said flared end of said funnel shaped portion comprises a closing face that includes a harness receiving aperture, from the rim of which a second tubular portion protrudes outwardly.

12. The grommet according to claim 11, wherein said second tubular portion is formed of two arched channels which extend from said closing face adjacent said harness receiving aperture.

13. The grommet according to claim 1, wherein said funnel-shaped portion contains at least one auxiliary tube extending along a line parallel to said longitudinal axis, and wherein a first end of said at least one auxiliary tube extends out through said conical wall of said funnel shaped portion, while a second end of said at least one auxiliary tube extends beyond said flared end of said funnel shaped portion.

14. The grommet according to claim 13, wherein said at least one auxiliary tube comprises a reinforcing device.

15. The grommet according to claim 14, wherein said at least one auxiliary tube comprises an external circular face, and said reinforcing device comprises at least one elongate link binding said external circular face of said at least one auxiliary tube to said conical wall of said funnel shaped portion.

16. The grommet according to claim 14, wherein said at least one auxiliary tube comprises an external circular face, and said reinforcing device comprises at least one longitudinal rib extending along a line spaced from said at least one elongate link.

17. The grommet according to claim 14, wherein said at least one auxiliary tube comprises an internal circular face, and said reinforcing device comprises at least one circular rib provided thereon.

18. The grommet according to claim 13, wherein said at least one auxiliary tube comprises a first auxiliary tube configured to receive a washer hose and a second auxiliary tube configured to receive a hood wire.

19. The grommet according to claim 13, wherein said flared end of said funnel shaped portion comprises a closing face that includes a first auxiliary aperture, a harness-receiving aperture and a second auxiliary aperture that are centrally aligned substantially along a common diameter line of said closing face and arranged in that order along said diameter line, and communicate with each other through an open

passage, and wherein a second tubular portion extends outwardly from the rim of said harness-receiving aperture and said at least one auxiliary tube protrudes outwardly through said corresponding first and second auxiliary apertures.

20. The grommet according to claim 1, wherein said external circular groove defines a first groove wall section substantially in a plane normal to said longitudinal axis of said grommet, located at a groove side nearest to said flared end, and a second groove wall section inclined towards said flared end, located at a groove side closest to said narrowed end, whereby said funnel shaped portion is caused to be squeezed around said inclined wall when said grommet is passed through the through-hole.

21. The grommet according to claim 20, wherein said plurality of funnel ribs have first end sections adjacent said circular joint section and second end sections adjacent said second groove wall section, and radiate in multiple directions from said first end sections to said second end sections on said external conical face of said funnel shaped portion, and said funnel ribs comprise an outermost face having a radial projection which decreases substantially from said first end section to said second end section.

22. The grommet according to claim 20, wherein said funnel ribs have an outermost face which subtends a first angle relative to said longitudinal axis, from said first end section of said funnel ribs to a first mark where said grommet comes into contact with said peripheral rim of said through-hole when it is mounted, and said outermost face subtends a second angle which is smaller than said first angle, from said first mark to a second mark where said outermost face substantially extends to

the level of the radial distance, perpendicular to said longitudinal axis, of said second groove wall section.

23. The grommet according to claim 22, wherein said outermost face extends substantially parallel to said longitudinal axis from said second mark to said second end portion of said funnel ribs.

24. The grommet according to claim 23, wherein said funnel shaped portion comprises a peripheral notch adjacent said second mark.

25. A wiring system including a grommet configured for mounting a vehicle wire harness which contains a water-trapping zone;

said grommet comprising:

a longitudinal axis;

a funnel shaped portion and a tubular portion joined thereto by a circular joint section;

said funnel shaped portion having a generally conical wall with external and internal generally conical faces and a flared end, the external generally conical face comprising a plurality of funnel ribs and an external circular groove with a groove base;

wherein said external circular groove is engageable with a through-hole formed in a body panel of a vehicle; and

wherein said funnel shaped portion comprises a device to improve flexibility of and/or space availability for the wire harness when mounted, including one of:

an extended tubular portion configured to hold the water trapping zone of the wire harness;

a structural configuration allowing the length of said grommet along said longitudinal axis of the funnel shaped portion to be reduced, such that the wire harness can be wired substantially alongside the body panel; and

a circular space between said plurality of funnel ribs near the circular joint section and said tubular portion;

wherein the body panel is positioned between an engine compartment and a passenger compartment, said tubular portion of said grommet containing a wire harness is inserted from the engine compartment to the passenger compartment through the through-hole and the through-hole is fitted with said external circular groove, whereby said tubular portion extends inside the passenger compartment and can be bent together with the wire harness.

26. The wiring system according to claim 25, wherein said extended tubular portion extends from said circular joint section toward the inside of said funnel shaped portion.

27. The wiring system according to claim 25, wherein said structural configuration has a length L along said longitudinal axis from said groove base of said funnel shaped portion to said narrowed end thereof, and a diameter D in the plane normal to said longitudinal axis including said groove base, and the ratio of L:D is in the range of approximately 1:5 to 1:3.

28. The wiring system according to claim 25, wherein said plurality of funnel ribs have first end sections adjacent said circular joint section and second end sections

and radiate in multiple directions from said first end sections on said external conical face of said funnel shaped portion, and wherein said first end sections form a circular space around said tubular portion, such that said tubular portion can be flexed independently from said plurality of funnel ribs.

29. The wiring system according to claim 25, wherein said flared end of said funnel shaped portion comprises a closing face that includes a harness receiving aperture from the rim of which a second tubular portion extends outwardly.

30. The wiring system according to claim 25, wherein said funnel shaped portion comprises at least one auxiliary tube extending along an axis parallel to said longitudinally axis, and a first end of said at least one auxiliary tube extends out through said conical wall of said funnel shaped portion, while a second end of said at least one auxiliary tube extends beyond said flared end of said funnel shaped portion.

31. The wiring system according to claim 25, wherein said external circular groove defines a first groove wall section substantially in a plane normal to said longitudinal axis of said grommet, located at a groove side nearest to said flared end, and a second groove wall section inclined toward said flared end, located at a groove side closest to said narrowed end, whereby said funnel shaped portion is caused to be squeezed around said inclined wall when said grommet is passed through the through-hole.